SOCIETY FOR PLANT MORPHOLOGY AND PHYSIOLOGY.

ITHACA MEETING, DECEMBER 28–29, 1897.[1]

THE first meeting of the new Society for Plant Morphology and Physiology was held in conjunction with the meetings of the American Society of Naturalists and the affiliated societies at Cornell University, December 28 and 29, 1897. An account of the formation and personnel of this society is given elsewhere in this number. The following papers were presented:

1. *A mycorhiza in the roots of the liliaceous genus Philesia*: Dr. J. M. MACFARLANE, University of Pennsylvania.—The author stated that this was the second recorded case of symbiosis between a liliaceous plant and a fungus. The genus Philesia grows in the damp humus soil of west Patagonia, and forms coralloid root masses. The fungus was sparingly present outside the roots, also in the epidermis and exocortex, but formed an abundant growth in the mesocortex, the cells of which rapidly became filled with coiled fungoid hyphæ. The large spherical starch grains of these cells were acted on by the hyphæ, and were dissolved by solution rather than by corrosive action. A large amount of proteid material then appeared in the hyphæ. With growth of the root extremity, the fungus steadily penetrated the mesocortex cells of the growing point, numerous hyphæ being observed in the 10th–12th zone of cells behind the apex. Invariably the crystal cells were left untouched.

The close similarity of the above to cases recorded by Groom for Thismia, and by other authors, was referred to, but

[1] This report is furnished by the Secretary, Professor W. F. Ganong, Northampton, Mass. The abstracts are in all cases by the authors.

the conclusion was reached that while the fungus might for many generations aid the host in the elaboration of protein compounds that were absorbed by the latter, ultimately, though very gradually, the fungus proved a destructive agent.

2. *Studies on some mycelium and fungi from a coal mine :* PROFESSOR GEO. F. ATKINSON, Cornell University.— On the 14th of September the speaker explored abandoned portions of the Algonquin coal mine near Wilkesbarre, Pa., for the purpose of studying the mycelium formations on the doors in the gangways, and on the wood props which are used to support weak places in the roof above. Several flash-light photographs were made of the remarkable displays of the mycelium some four hundred feet below the surface, and of some of the fruit forms. Mature fruit collected has been determined as follows : *Polyporus versicolor*, *P. annosus*, *Coprinus micaceus*, *Stropharia*, *Hymenochæte*, *Merulius*, etc. The paper was illustrated with lantern views.

3. *Is there a basidiomycetous stage in the life-history of some Ascomycetes ?:* DR. E. A. BURT, Middlebury College.— Mr. Burt has been studying a case of undoubted association of *Graphium giganteum* (Pk.), otherwise known as *Dacryopsis Ellisiana* (Berk.) Massee, with the ascomycete *Lecanidion leptospermum* (Pk.), also known as *Holwaya tiliacea* E. & E. *Dacryopsis Ellisiana* was described and figured by Massee as a tremelloid basidiomycete. Mr. Burt has been unable, by the study of collections made in the months of August, October, November, and December, to confirm Massee's observations on the basidiomycetous nature of *Dacryopsis Ellisiana*, and therefore is unable to conclude, for the present, that it is a basidiomycetous stage of the ascomycete *Lecanidion leptosperma*.

4. *Additional notes on the bacterial brown rot of cabbages:* DR. ERWIN F. SMITH, Department of Agriculture.— Field studies of this disease were made in Michigan, Wisconsin, Ohio, and New York in August, September, and October of 1897. These served

to confirm the earlier published statements of the writer[2] respecting the manner of infection and the usual symptoms. A number of new facts which appear to have an important economic bearing were also brought to light. Some of these discoveries are as follows: (1) this disease is serious in many parts of the United States; (2) the greater part of the infections take place through natural openings of the plant, *i. e.*, through water pores located on the serratures of the leaves; (3) the disease is frequently disseminated by insects; (4) the wild mustard, *Brassica sinapistrum*, is one of the common host plants; (5) the disease is very frequently disseminated by man, *i. e.*, by making seed beds on infected soil and transplanting the germs in infected seedlings to land previously free from it; (6) when a soil has once become infected there is reason to believe that the germs are capable of living in it for a series of years and will attack cabbages which are planted on it; (7) the disease may be restricted by planting seed beds on healthy soil; by transplanting, as far as possible, to sod land, or at least to land not previously occupied by crucifers; by destroying wild mustards and parasitic insects; by removing badly affected plants bodily; and in early stages of the disease, *i. e.*, when the disease has only recently passed out of the water pore stage of infection, by removing affected leaves. A full account of the economic aspects of this disease has been published by the Department of Agriculture in the shape of a farmer's bulletin, which may be had on application. Cultures of the parasitic and dried leaves and stems of cabbage showing the characteristic symptoms were passed around.

5. *Occurrence of Kramer's bacterial disease on sugar beets in the United States:* DR. ERWIN F. SMITH, Department of Agriculture. —Attention was called to the existence in parts of the United States (Michigan, Wisconsin, etc.) of a disease of sugar beets much resembling if not identical with that described by Kramer and Sorauer in 1891–2, and more recently by Busse.[3] The

[2] Science 5: 963. 1897; Centralb. f. Bakt. 3[2]: 284. 1897.

[3] Zeitschr. f. Pflanzenkr. 7: 65.

root shrivels in places, becomes very black, and finally breaks down here and there, with the formation of a sticky exudate composed of bacteria. Cultures from the interior of blackened roots remained sterile. Cultures from the syrupy exudate yielded an organism resembling, so far as tested, that described by Busse as the cause of the disease. It is yet too early, however, to say whether the organism isolated is identical with *Bacillus betae* Busse, or whether it is in any sense a true parasite. It appears worth mentioning, inasmuch as it seems to be rather common, and destroys cane sugar, and grape sugar, with the formation of hydrogen, carbon dioxide, and an acid. Possibly this is one of the organisms which has given trouble to the chemists in sugar diffusion work, inverting the cane sugar and liberating gases.[4] Cultures on steamed and raw beets, on steamed potato, and in fermentation tubes were exhibited. On steamed slices of sugar beet there is a copious production of gas.

6. *Are blepharoplasts distinct from centrosomes?:* MR. HERBERT J. WEBBER, Department of Agriculture.—Blepharoplasts, the speaker pointed out, are special organs of the spermatic cells of Zamia, Ginkgo, and some Filicineæ and Equisetineæ, which in certain stages of their development somewhat resemble centrosomes. Two are formed in each generative cell, arising *de novo* in the cytoplasm on opposite sides of the nucleus, and about midway between the nuclear membrane and cell wall. The division of the generative cell results in the formation of two antherozoids, one blepharoplast being located in each antherozoid cell. During this division the blepharoplasts burst and the outer membrane becomes gradually extended into a narrow helicoid spiral band from which the motile cilia of the antherozoid are developed.

The blepharoplasts resemble typical centrosomes: (1) in position, being located on the opposite sides of the nucleus, and (2) in having the kinoplasmic filaments focused upon them dur-

[4] See Jour. Soc. Chem. Ind. 14:876.

ing the prophases of the division of the generative cell. They differ from typical centrosomes, however, (1) in arising *de novo* in the cytoplasm; (2) in growing to comparatively enormous size; (3) in not forming the center of an aster at the pole of the spindle during mitosis; (4) in having a differentiated external membrane and contents; (5) in bursting and growing into a greatly extended cilia-bearing band, the formation of which is evidently their primary function; (6) in their non-continuity from cell to cell.

7. *Spore formation in some sporangia:* DR. R. A. HARPER, Lake Forest University.—DR. Harper's paper is to be published with some additional material in the near future.

8. *Two new organs of the plant cell:* MR. WALTER T. SWINGLE, Department of Agriculture.—The author announced the finding of two new organs or organoids, the one *vibrioid*, occurring abundantly in the superficial layers of the cytoplasm of some Saprolegniaceæ and some Florideæ; the other being a central body in the developing egg of *Albugo candidus*. The vibrioids are slender cylindric sharply delimited bodies, about the size of many common bacilli, but exhibiting rather slow bending or undulatory proper motions in addition to translatory movements which are probably passive and due to the streaming of the cytoplasm in which they are imbedded. They are fixed well by ordinary killing agents, and when stained are very sharply differentiated from the surrounding cytoplasm. They can also be seen in the living cell. Their appearance suggests that they may be minute endo-parasites, but their constant occurrence in plants in all stages of development and from widely separated localities militates against this view. Their function in unknown.

The other new organoid is a nearly spherical body located at one end of the egg nucleus of *Albugo candidus*. It is often a little flattened on the side adjoining the nucleus, is not very sharply delimited from the cytoplasm, but stains differentially. It seems to be more or less granular in structure, appears just before delimitation of the egg within the oogonium, and disappears after fusion of the male and female nuclei. It probably plays some part in these two phenomena.

Both of the organoids have been observed before, but were not correctly described by previous writers.

9. *Notes on the archesporium and nucleus of Bignonia:* MR. B. M. DUGGAR, Cornell University.—The mature archesporium of the microsporangia occupies a single boot shaped layer. The primitive archesporium is differentiated by periclinal divisions in certain regions of the outer layer of periblem. The tapetum on the outer side is cut off by the next periclinal divison of the hypodermal layer, and the next division of the latter gives rise to the layer often becoming the fibrillar endothecium of anthers, but in Bignonia there is no fibrillar development. In general, there are no further periclinal divisions in the regions mentioned. The definitive archesporium is formed by not more than a single division in some or all of the primitive archesporial cells. The macrosporic archesporium apparently develops no primary tapetum, divides simultaneously from the two-celled stage, the third or fourth cell becoming the definitive embryo-sac mother cell. The archesporial nucleus, especially, is peculiar in the large nucleolar-like structure which does not stain homogeneously, the outer portion usually taking the violet in the Flemming combination.

10. *Some theories of heredity and of the origin of species considered in relation to the phenomena of hybridization:* MR. WALTER T. SWINGLE, Department of Agriculture.—Owing to limited time the speaker treated only the first portion of his theme, viz., the bearing of the facts of hybridization on some theories of heredity. It was pointed out that Weismann's theory of reduction of chromosomes, though giving a plausible explanation of the differences observed between the first (uniform) and second (polymorphic) generations of most hybrids, is not only in disaccord with the observed phenomena of spore and pollen formation in

higher plants, but fails to account for the extreme polymorphism often observed in the first generation of hybrids between races of cultivated plants, or between closely related species, as for example some racial hybrids of maize and some specific hybrids of Lychnis and Digitalis. Mr. Swingle considered it necessary to assume in some such cases, at least, a predetermination of the characters of the hybrid at the time of fusion of the male and female nuclei. The male and female chromosomes probably persist side by side unchanged in number, and possibly unchanged in quality during the whole of the ontogeny of the hybrid, reduction not occurring until the close of the first generation. It is therefore necessary to assume, in order to explain the observed fact of divergence of character in the first generation of some hybrids, that the influence exerted during ontogeny of the hybrid by the material bearers of heredity is, at least in some cases, a function of their relative positions; and further that in most cases the relative positions of these bearers of heredity, as determined at the moment of fusion of the male and female nuclei, persist unchanged throughout ontogeny of the offspring. Some phenomena, such as reversions to the one or the other parent form by a larger or smaller portion of the hybrid, would be explained by assuming some change in the disposition of the hereditary substance, whereby they assumed a new position of partial or complete stability. The suggestion was made that possibly the difference between uniform and polymorphic hybrids of the first generation is due to a more complete intermingling of the hereditary particles in case of polymorphic hybrids (offspring of closely related organisms), whereby many differing combinations would be possible, and in case of uniform hybrids (mostly offspring of distinct species or very different races of the same species), to greater or less aversion to commingling between the two more diverse sorts of particles, whereby they would remain in two separate groups and affect ontogeny uniformly and equally.

Xenia, or the communication of paternal characters to parts of the mother plant in the immediate neighborhood of the developing embryo, was held to be well established in case of some races of maize by the work of Dudley, Savi, de Vilmorin, Hildebrand, Körnicke, Sturtevant, Burrill, Kellerman and Swingle, McCluer, Tracy, Hays, and others, and in case of some races of peas, by the work of Wiegmann, Gärtner, Berkeley, Laxton, and Darwin. The converse phenomena of the mother plant influencing the characters of the developing embryo are occasionally reported, for instance in hybrids of Digitalis by Gärtner, and in hybrids of Nymphæa by Caspary.

These phenomena are inexplicable by most of the current theories of heredity and perhaps in consequence have been neglected. They necessitated the assumption that hereditary influences can be transported from cell to cell for some distance. The suggestion was made that this transport may occur either along the intercellular filaments which pass through the walls, or by means of diffusible substances capable of acting on the hereditary particles of distant cells. Townsend's proof of the conduction of the stimulus which results in wall formation, over long slender threads of protoplasm in plasmolyzed cells, may be considered as hinting at the possibility of the former explanation, while Beyerinck's claim, that the developing larvæ of some gall insects secrete substances which diffuse into and control the ontogeny of neighboring meristematic or partially developed tissue cells of the host plant, furnishes some ground for the latter hypothesis.

11. *The variable effects of hydrocyanic acid gas on plants and animals:* MR. ALBERT F. WOODS, Department of Agriculture.— Plants of various families and in different stages of growth were subjected to varying amounts of hydrocyanic acid gas, and were found to be affected by it in different degrees, according to the kind of plant, its age, and other conditions of growth and development. Animals, mainly insects, were also found to vary, even within the same family, in like manner. Mites were the most resistant of any of the organisms studied, often recovering after several hours of complete paralysis and apparent death.

12. *Effect of alternating dryness and moisture on the germination of some seeds:* MR. A. J. PIETERS, Department of Agriculture.—The experiments recorded are preliminary to more extensive ones now in progress, but they show clearly that for some seeds germination is quickened by thorough drying after a long period of dampness. In most cases, after a small percentage of germination for the first one hundred days or more, drying for two weeks, followed by wetting, resulted in a germination of from 15 to 54 per cent. in a few days. In the check pots, meanwhile, the seeds either did not germinate, or only a small percentage did so.

13. *Experiments on the morphology of Arisæma triphyllum:* PROFESSOR GEO. F. ATKINSON, Cornell University.—Female, male, and neuter plants, the history of which was known by growing them in pots for one season, were potted, some in rich soil and others in poor soil, the object being to change them from male to female, etc., by varying amounts of nutriment. Male plants in rich soil were in one year changed to female, and large neuter plants in rich soil were changed to female.

In a second series, large two-leaved female plants, with large bulbs, were selected at the time the fundament of the flowers was formed. The bulbs were cut so as to remove all but a small portion in connection with the bud. By this removal of the larger part of the stored food the plants were changed to male.

14. *On polyembryony and its morphology in Opuntia vulgaris:* DR. W. F. GANONG, Smith College.—The author has found this species markedly polyembryonic, the polyembryony having a double morphological basis. One set of embryos comes from a mass of tissue which appears to develop from the fertilized egg cell, the others spring from the wall of the embryo sac, but not from the nucellus, and probably arise from endosperm cells, which if true is a mode hitherto unknown. The literature of the subject was summarized and some remarks given upon the significance of polyembryony.

15. *Contributions to the morphology and biology of the Cactaceæ. Part II.— The comparative morphology of the embryos and seedlings:* DR. W. F. GANONG, Smith College.— This paper is a continuation of the author's earlier studies upon this family. It describes and figures germinated embryos of most of the genera and many important species, discusses the germination and growth of the embryos, their form- size- and color-factors, and the features they show of importance for the determination of the phylogeny of the genera, the development of the seedlings, and the unfolding of the peculiar morphological features of the adult plants.

16. *The morphological significance of the lodicules of grasses:* DR. W. W. ROWLEE, Cornell University.— A study of the flowers of the bamboos leads to the conclusion that the lodicules of grasses represent a reduced perianth. The three lodicules in the flower of Arundinaria alternate on the axis with the stamens, and may therefore be considered the inner whorl or petals. The stamens are directly opposite the midribs of the carpels and indicate that the inner whorl of stamens, present in some bamboos, is suppressed in Arundinaria. Hackel, as is well known, interpreted the lodicules as distichous bracts.

17. *Observations on the American squaw-root* (*Conopholis Americana* Wallr.): DR. LUCY L. W. WILSON, Philadelphia.— An exhaustive study of the vegetative and reproductive parts had been made, but an account of the former only was read. The invariable host plant was the oak. The extreme degradation of the parasite, and the intimate relation between it and the oak roots caused the author to compare it with members of the Balanophoreæ and Rafflesiaceæ, rather than with parasitic members of the Scrophulariaceæ. The seedling parasite seemed early to attack young oak roots, and steadily grew for ten to twelve years, until a huge mass six inches across might be formed. This mass was chiefly characterized by the abundance of sclerenchyma patches, developed by the oak host through the irritant

action of the invading parasite. The presence of stomata on the stem and their absence on the scale leaves was pointed out, while the double circle of bundles traversing the flowering stem was peculiar in that the xylem of these faced each other.

18. *Water storage and conduction in Senecio praecox from Mexico:* DR. JOHN W. HARSHBERGER, University of Pennsylvania.—*Senecio praecox* (Cav.) DC. is a composite plant inhabiting the volcanic beds of the valley of Mexico. It has a cylindrical, succulent, woody stem rising three or four feet from the ground, with clustered deeply lobed leaves at the top. The plant stores up an abundant supply of water in the pith, which is gradually used up during the dry season in Mexico, which lasts from October to June. The flowers develop in April at the expense of the reserve supply of water. Loss of water during the dry season is prevented by the fall of the leaves, and by protective cork and balsam, the latter secreted in the exocortex and endocortex. The water, stored in turgid disks of pith, is gradually conducted by the woody cells and tracheids which penetrate into the medulla by wedge shaped ingrowths, representing the primary bundles, to the growing point where it is used. That this is the case is shown by the dry parchment-like pith membranes which were left in a piece of a stem which had remained in the dry state for over sixteen months. Conduction of water in this stem was accomplished without assistance of root pressure, and without any appreciable influence on the part of the small green leaves in drawing up the liquid by aid of the transpiration current.

19. *Notes on the embryology of Potamogeton:* MR. K. M. WIEGAND, Cornell University.—*Potamogeton pauciflorus* was studied with reference to the origin and development of the embryo sac, fertilization, and development of the embryo. The embryo sac was found to arise in the usual manner for monocotyledons, viz., from the subepidermal cell after the cutting off of a tapetal cell. The egg apparatus and antipodals were

however, somewhat abnormal. Although the normal number of cells in each was present, they were formed irregularly. The polar nucleus and first and second synergids seem to have been cut off successively from the mother nucleus of the egg. The synergids disappear almost immediately. A similar irregularity was found in the antipodals; but the most interesting feature, perhaps, was the fact that the definitive nucleus cuts off a very large basal nucleus, as in Sagittaria, before endosperm formation proceeds in the upper part of the sac.

20. *Recent experiments and observations on fruit production in Amphicarpæa:* DR. ADELINE SCHIVELY, Philadelphia Normal School.—This paper detailed the author's recent studies on the hog peanut (*Amphicarpæa monoica*). Her published observations showed that minute aerial cleistogamous flowers, when buried, produced one-seeded "nuts" with soft fruits and seed coats, instead of the two to three-seeded pods with indurated walls. She now showed that when purple flowers were buried in the bud state, while still attached to the plant or at any period up to the time of fertilization, perfect underground "nuts" matured, instead of three to four-seeded indurated pods. Various conclusions were drawn as to the powerful action of environmental agents in determining the size, shape, and consistence of the seed, the induration of its coats, and the number of seeds that might be produced.

21. *On the formation of cork tissue in roots of the Rosaceæ:* DR. MARTHA BUNTING, Philadelphia High School.—Starting from observations on *Geum urbanum* and *G. rivale*, made by Professor Macfarlane in 1890, when intercellular spaces were shown to exist between cork cells, Dr. Bunting proved this condition to be typical for all herbaceous and shrubby species examined, but to be absent in roots of arborescent species. She described the alternation of a flattened, usually pigmented layer of cells, with one to three layers of rounded cells in each annual ring, the flattened layer being the last produced each season. Protoplasm,

nuclei, and starch grains existed in cork zones four to five layers removed outside the phellogen.

22. *The structure and developmant of internal phloem in Gelsemium sempervirens:* MISS CAROLINE THOMPSON, University of Pennsylvania.—The author showed that the internal phloem originated as four longitudinal tracts in the primary meristem, and steadily increased until by the eighth or tenth year it had entirely pressed together and destroyed the pith. During the first year nourishment of the pith ceased, owing to the differentiation of two layers of cells, which were referred to as the "phloem sheath."

A remarkable distribution of the internal phloem was shown to exist in the petiole, at the base of which a bicollateral bundle arrangement existed, but this quickly changed to the ordinary collateral relation by the passage of the upper (internal) phloem through the xylem of the petiole. Each bundle in passing out into the petiole subdivided into three parts, two of which remained in the stem and soon came together again, while the third passed out and behaved as above described.

From the second year onward, the internal phloem patches of the stem show areas of crushed and obliterated tissue, where the previously formed phloem had been pushed inwards by the younger elements. In older stems eight large phloem patches formed by division of the original four, entirely filled up the pith area.